0019

WATER QUALITY MEMORANDUM

Utah Coal Regulatory Program

July 12, 2006

TO: Internal File

THRU: D. Wayne Hedberg, Permit Supervisor

FROM: Dana Dean, P.E, Senior Reclamation Hydrologist

RE: 2005 Second Quarter Water Monitoring, Nevada Electric Investment Corporation, Wellington Preparation Plant, C/007/0012-WQ05-2, Task #2534

The Wellington Preparation Plant is currently idle. No mining or coal processing activities currently take place there, nor is the site in active reclamation.

Pertinent water monitoring requirement information is in the MRP in Sections 7.23, and 7.31.2-22, and tables 7.24-2, and 7.24-5.

1. Was data submitted for all of the MRP required sites? YES ☒ NO ☐

Springs –

The Permittee is not required to monitor any springs at the Wellington Preparation Plant.

Streams –

The Permittee is required to sample SW-1, SW-2A, SW-3, SW-4, SW-5, SW-6, SW-7, and SW-8 for flow, and the laboratory parameters outlined in Table 7.24-5 each quarter. They are to sample SW-2 for flow-only each quarter.

The Permittee monitored and reported the essential data for all streams as required during this quarter.

Wells–

The Permittee is required to sample GW-1, GW-3, GW-4, GW-6, GW-7, GW-8. GW-9, GW-9B, GW-10, GW-12, GW-13, GW-14, GW-15A, GW-15B, GW-16, and GW-17 for depth, and the laboratory parameters outlined in Table 7.24-2 each quarter. They are to sample GW-2 for depth-only each quarter.

The Permittee monitored and reported the essential data for all wells as required during this quarter.

UPDES–

There are six active UPDES sites at the Wellington Preparation Plant. They are all under the permit #UTG040010, and include outfalls 003, 004, 005, 006, 007, and 008. The Permittee is required to monitor each UPDES site monthly.

The Permittee monitored and reported the essential data for all UPDES sites as required during this quarter. None of the UPDES sites recorded any flow during the period.

2. Were all required parameters reported for each site? YES ☐ NO ☒

There was not enough water at GW-3 to properly purge/sample. For this reason, the Permittee was unable to sample the water, and only recorded depth information.

3. Were any irregularities found in the data? YES ☒ NO ☐

Several parameters fell outside of 2 standard deviations from the mean encountered at the respective sites. They were:

Site	Parameter	Value	Standard Deviations from Mean	Mean
SW-1	Dissolved Potassium	2.14 mg/L	2.01	6.41 mg/L
SW-2A	Dissolved Potassium	2.21 mg/L	2.29	6.67 mg/L
SW-2A	Dissolved Sodium	36.3 mg/L	2.06	230.21 mg/L
SW-2A	Chloride	13 mg/L	2.08	62.3 mg/L
SW-2A	Sulfate	104 mg/L	2.24	993.21 mg/L
SW-2A	Lab Specific Conductivity	750 μmhos/cm	2.19	2282.79 μmhos/cm
SW-2A	Total Dissolved Solids	444 mg/L	2.31	1863.79 mg/L
SW-2A	Total Cations	8.1 meq/L	2.05	27.12 meq/L
SW-2A	Total Anions	8.5 meq/L	2.07	28.35 meq/L
GW-1	Total Dissolved Solids	4580 mg/L	2.99	4936.25 mg/L
GW-8	Dissolved Iron	2.13 mg/L	3.53	0.24 mg/L
GW-9	Total Selenium	170 μg/L	20.74	17.38 μg/L
GW-9B	Dissolved Calcium	555 mg/L	2.61	409.88 mg/L
GW-9B	Dissolved Magnesium	735 mg/L	4.05	653.28 mg/L
GW-9B	Total Cations	161 mg/L	2.35	139.39 mg/L
GW-12	Dissolved Iron	54.2 mg/L	3.14	13.31 mg/L
GW-13	Dissolved Sodium	3,490 mg/L	2.20	3,911.88 mg/L
GW-15A	Dissolved Calcium	459 mg/L	4.82	383.82 mg/L
GW-15A	Sulfate	2207 mg/L	2.65	1,766 mg/L

GW-15A	Total Alkalinity	577 mg/L	3.82	518.94 mg/L
GW-15A	Total Hardness	1,978 mg/L	3.05	1,653.83 mg/L
GW-15A	Lab Specific Conductivity	4330 µmhos/cm	3.12	3,684.17 µmhos/cm
GW-15A	Total Cations	54.9 meq/L	2.09	46.94 meq/L
GW-15A	Total Anions	59.8 meq/L	2.64	49.32 meq/L
GW-15B	Dissolved Sodium	245 mg/L	2.78	275.64 mg/L
GW-15B	Total Alkalinity	458 mg/L	2.83	486.78 mg/L
GW-16	Dissolved Calcium	358 mg/L	2.10	317.71 mg/L
GW-16	Total Hardness	1960 mg/L	2.25	1773 mg/L
GW-16	Total Cations	58.6 mg/L	2.17	54.19 mg/L

There is no real trend in the chloride at SW-2A (R2 = 0.003), and no correlation to flow. The drinking water criterion for chloride is 250 mg/L. It is not clear why the levels decreased slightly this quarter, but they are not of concern at this time.

The dissolved calcium levels have an overall upward trend at each of the listed sites. There is a weak correlation to water level for each of the sites; positive at GW-9B, and negative at GW-15A and GW-16. There are no criteria for this metal, but it does contribute to water hardness. The hardness at each of these sites has always fallen into the hard (150-300 mg/l) to very hard (>300 mg/l) classifications, with most samples over 1800 mg/l (100% of all samples over 1000 mg/L, 67% over 1800 mg/L). It is not clear why the calcium level has been changing, but this does not represent a degradation of water quality.

Dissolved magnesium has a slight upward trend at GW-9B. There is a very weak positive correlation to water level. There are no criteria for this metal, but it contributes to water hardness, which has a slight downward trend at this site. Since the hardness is not being raised, the raise in magnesium does not degrade the water quality.

The dissolved potassium was lower than average at SW-1 and SW-2A. There is a very weak upward trend in potassium at SW-2A, and no real trend in potassium at SW-1. There is a fairly strong negative correlation between potassium levels and flow at both SW-1, SW-2A. There are no water quality standards for potassium and this lowering of the potassium level does not hurt the water quality.

The dissolved sodium was lower than average at SW-2A, GW-13, and GW-15B. There is no real trend at SW-2A, but there is a downward trend in sodium levels at GW-13 and GW-15B. There is a fairly strong negative correlation to flow/well elevation at SW-2A, and GW-13, and a weak positive correlation to well elevation at GW-15B. There is no water quality standard for sodium, but it does increase the salinity of water. High salinity in irrigation water can decrease yields, depending on the crop. The reduction in sodium is a positive trend.

There is a fairly strong upward trend in sulfate at GW-15A, but no real trend at SW-2A.

There is no strong correlation between sulfate and well elevation at GW-15A, but a strong negative correlation to flow at SW-2A. Though the sulfate reading at GW-15A is quite high, there is no indication of acid mine drainage (AMD), since the pH has remained at or above 6.8, and the total alkalinity of the water is quite high. Sulfate is not toxic to plants or animals (even at very high concentration), but has a cathartic effect on humans in concentrations over 500 mg/L. For this reason, the EPA has set the secondary standard as 250 mg/L. The sulfate at GW-15A has always been at or above 1460 mg/L. The drop in sulfate at SW-2A is most likely due to the increased flow this quarter, and is an improvement to the water quality.

There is a weak upward trend in the total alkalinity at GW-15A (R2=0.295), and a fairly strong downward trend at GW-15B (R2= 0.500). The upward trend at GW-15A is welcome, since it means the water is better able to buffer any acids it may encounter. Though the downward trend at GW-15B is not desirable, it has just dropped from 508 mg/L at the highest to 458 mg/L at the lowest, which is still quite a high number. In addition the pH at GW-15B has only been below 6.9 once (in 1998) and the pH actually has a very weak *upward* trend at this site. Alkalinity is an important measure of buffering capacity (ability to absorb acids without lowering pH), and the Division will continue to monitor the trend of this parameter.

The number of anions counted is unusually low at SW-2A, and unusually high at GW-15A. The number of cations counted is unusually low at SW-2A, and unusually high at GW-9B, GW-15, and GW-16. There is a negative correlation to flow/water level, except for cations at GW-16, which have a positive correlation to water level. The cation/anion balance is within the 5% recommended limit at each of these sites. The number of cations and anions relate to the total dissolved solids in the water sample, and that number is not out of the ordinary, except at SW-2A and GW-1.

There is a strong upward trend in the total dissolved solids (TDS) at GW-15A, with a strong negative correlation to water level. The water level at GW-15A has been steadily trending downward since the Permittee began monitoring (R^2=0.74), however the overall pattern follows the PHDI for the area quite closely. The TDS at GW-15A has only been below 3000 mg/L once (2720 mg/L, well above the EPA's secondary standard of 500 mg/L for drinking water). There is no trend in TDS at SW-2A, but there is a strong negative correlation to flow. A reduction in total dissolved solids is an improvement to water quality, and not a concern at this time.

There is a fairly strong upward trend in the total hardness at GW-15A, with a fairly strong negative correlation to water level. The water level at GW-15A has been steadily trending downward since the Permittee began monitoring (R^2=0.74), however the overall pattern follows the PHDI for the area quite closely. In any case, the hardness at GW-15A has never been below 1500 mg/L, which is well into the very hard (>300 mg/L) range. This does not represent a degradation of the water quality. There is a no real trend in hardness at GW-16, with no correlation to flow. Though this is the highest hardness value recorded at the site, the hardness at GW-16 has never been below 1600 mg/L, which is well into the very hard (>300 mg/L) range. This does not represent a degradation of the water quality.

This quarter's dissolved iron values at GW-8 and GW-12 are the highest ever recorded at those sites. There is a weak upward trend in the dissolved iron at each site. There is also a weak negative correlation to water level. The secondary water quality standard for iron (based on taste and appearance only) is 0.3 mg/l, and for industrial use, the limit is 0.2 mg/l. The aquatic life standard (warm water fisheries) is 1.0 mg/l. Since the groundwater at the Wellington Preparation Plant does not support aquatic life, and the iron has usually been above 0.2 mg/l, the rise in dissolved iron does not represent a degradation of water quality.

There is a very slight upward trend in total selenium at GW-9B ($R^2 = 0.082$), with a weak negative correlation to flow. The value is actually down this quarter. The drinking water quality standard for selenium is 0.05 mg/L, the fresh-water aquatic life standard is 0.005 mg/L, and the human-life standard is 170 mg/L. The selenium at GW-9B has always been above the drinking water quality standard and the aquatic life standard. It is still well below the human-life standard. This water is not used as a fishery or for drinking water, and this change in selenium does not represent a degradation of water quality.

Several routine Reliability Checks were outside of standard values. They were:

Site	Reliability Check	Value Should Be...	Value is...
SW-1	Conductivity/Cations	> 90 & < 110	82
SW-1	Mg/(Ca + Mg)	< 40 %	48%
SW-2A	Conductivity/Cations	> 90 & < 110	85
SW-2A	Mg/(Ca + Mg)	< 40 %	48%
GW-1	TDS/Conductivity	>0.55 & <0.75	1.15
GW-1	Conductivity/Cations	> 90 & < 110	57
GW-1	Mg/(Ca + Mg)	< 40 %	50%
GW-1	Ca/ (Ca + SO4)	> 50 %	27%
GW-4	TDS/Conductivity	>0.55 & <0.75	0.99
GW-4	Conductivity/Cations	> 90 & < 110	71
GW-4	Mg/(Ca + Mg)	< 40 %	53%
GW-4	Ca/ (Ca + SO4)	> 50 %	25%
GW-6	TDS/Conductivity	>0.55 & <0.75	0.91
GW-6	Conductivity/Cations	> 90 & < 110	74
GW-6	Mg/(Ca + Mg)	< 40 %	57%
GW-6	Ca/ (Ca + SO4)	> 50 %	25%
GW-7	Mg/(Ca + Mg)	< 40 %	60%
GW-7	Ca/ (Ca + SO4)	> 50 %	20%
GW-8	TDS/Conductivity	>0.55 & <0.75	1.24
GW-8	Conductivity/Cations	> 90 & < 110	53

GW-8	Mg/(Ca + Mg)	< 40 %	77%
GW-8	Ca/ (Ca + SO4)	> 50 %	11%
GW-9	Cation/Anion Balance	<5%	6.9%
GW-9	TDS/Conductivity	>0.55 & <0.75	1.50
GW-9	Conductivity/Cations	> 90 & < 110	38
GW-9	Mg/(Ca + Mg)	< 40 %	78%
GW-9	Ca/ (Ca + SO4)	> 50 %	11%
GW-9B	TDS/Conductivity	>0.55 & <0.75	1.34
GW-9B	Conductivity/Cations	> 90 & < 110	51
GW-9B	Mg/(Ca + Mg)	< 40 %	69%
GW-9B	Ca/ (Ca + SO4)	> 50 %	16%
GW-10	TDS/Conductivity	>0.55 & <0.75	1.55
GW-10	Conductivity/Cations	> 90 & < 110	43
GW-10	Mg/(Ca + Mg)	< 40 %	73%
GW-10	Ca/ (Ca + SO4)	> 50 %	10%
GW-12	TDS/Conductivity	>0.55 & <0.75	1.69
GW-12	Conductivity/Cations	> 90 & < 110	41
GW-12	Mg/(Ca + Mg)	< 40 %	80%
GW-12	Ca/ (Ca + SO4)	> 50 %	10%
GW-13	TDS/Conductivity	>0.55 & <0.75	1.36
GW-13	Conductivity/Cations	> 90 & < 110	52
GW-13	Mg/(Ca + Mg)	< 40 %	69%
GW-13	Ca/ (Ca + SO4)	> 50 %	8%
GW-14	TDS/Conductivity	>0.55 & <0.75	1.24
GW-14	Conductivity/Cations	> 90 & < 110	53
GW-14	Mg/(Ca + Mg)	< 40 %	72%
GW-14	Ca/ (Ca + SO4)	> 50 %	15%
GW-15A	TDS/Conductivity	>0.55 & <0.75	1.09
GW-15A	Conductivity/Cations	> 90 & < 110	62
GW-15A	Mg/(Ca + Mg)	< 40 %	42%
GW-15A	Ca/ (Ca + SO4)	> 50 %	33%
GW-15B	Cation/Anion Balance	<5%	5.4%
GW-15B	TDS/Conductivity	>0.55 & <0.75	1.04
GW-15B	Conductivity/Cations	> 90 & < 110	71
GW-15B	Ca/ (Ca + SO4)	> 50 %	35%
GW-16	TDS/Conductivity	>0.55 & <0.75	0.92
GW-16	Conductivity/Cations	> 90 & < 110	72
GW-16	Mg/(Ca + Mg)	< 40 %	55%
GW-16	Ca/ (Ca + SO4)	> 50 %	27%
GW-17	Cation/Anion Balance	<5%	5.1%
GW-17	TDS/Conductivity	>0.55 & <0.75	0.54

GW-17	Mg/(Ca + Mg)	< 40 %	65%
GW-17	Ca/ (Ca + SO4)	> 50 %	38%

The Permittee should work with the lab to make sure that samples pass all quality checks so that the reliability of the samples does not come into question. These inconsistencies do not necessarily mean that a sample is wrong, but it does indicate that something is unusual. An analysis and explanation of the inconsistencies by the Permittee would help to increase the Division's confidence in the samples. The Permittee can learn more about these reliability checks and some of the geological and other factors that could influence them by reading Chapter 4 of *Water Quality Data: Analysis and Interpretation* by Arthur W. Hounslow.

4. On what date does the MRP require a five-year re-sampling of baseline water data.

December 10, 2009

5. Based on your review, what further actions, if any, do you recommend?

No further actions are required at this time.

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